

Deconstruction as a Learning Tool

An Honors Thesis (ARCH 402)

by

Shawn Yoder

**Thesis Advisor
Jonathan Spodek**

A handwritten signature in black ink, appearing to read 'Jonathan Spodek', with a long horizontal flourish extending to the right.

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Muncie, Indiana**

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Abstract

Deconstruction is more than just a construction practice that has been introduced as an alternate to demolition. The environmental and educational benefits prove the need for sustainable practices such as reusing and recycling materials from old buildings. As construction and demolition wastes represent a substantial percentage of our landfill dumping each year, deconstruction attempts to reduce that amount, even to the point of recycling entire buildings. If architects and engineers are aware of deconstruction within the design process, buildings could be designed for multiple lifetimes. The process of deconstruction is analyzed as an opportunity to be a learning tool for design students and those in construction related fields.

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Introduction

Most architecture students come into college possessing little to no idea how an actual building is constructed. For four years, students blindly go through the design process without sufficient knowledge of the actual construction process, which is extremely important in understanding a building as a whole. In general terms, when a person tries to understand the whole, each specific piece must be first understood and taken into account. In architectural terms, this means that each small part of a building has a significant impact on how that building is actually perceived. Our job now is to try and understand each of those small pieces, but this is where the classroom can only achieve a certain level. From personal experience within the architectural department, it has been difficult to gain an understanding of how a building goes together simply from books. There was a need for something visual, something hands-on, a class focused on teaching students through experience where they were able to build a structure that was not simply conceptual.

This semester for my Architecture studio, I participated in the remodeling of an existing house here in Muncie. The studio, led by Professor Jonathan Spodek, was performed in association with ecoREHAB of Muncie. EcoREHAB is an organization that takes existing abandoned houses, redesigns and eventually remodels them to be sold as affordable, sustainable housing for low-income families. The following research focuses on the technique of deconstruction, which is part of the basis of this studio. In building terms, deconstruction is the process of taking apart a building for the purpose of reuse and remodeling. Through my experiences this semester (which were recorded in detail in an attached journal) as well as through extensive research, this study presents the art of deconstruction as a highly

recommended learning tool for students in construction related majors. Not only does deconstruction give understanding of how a building is assembled, but it also teaches students the importance of reuse and recycle as most of the materials removed from a building are able to be utilized elsewhere.

This research and my personal experiences this semester are not only extremely beneficially for me, but are equally as important for other students and professors as well. From this thesis, students and professors will be able to see the importance of deconstruction as a learning tool outside of the normal classroom environment. Deconstruction has the potential to become an extremely important facet of the architecture and construction programs here at Ball State and other universities around the country. This thesis is geared towards, but not limited to students. Contractors and architects already in the construction industry would greatly benefit from becoming familiar with deconstruction. It is a practice that has, and will continue to grow in the future. Now is the time that we understand the basics so we can expand our knowledge at the same rate as its growth.

Deconstruction: What is it?

Whether a person is familiar with construction or not, everyone has seen old, run-down buildings in their hometowns. These buildings represent a vast range of building types: from hundred-year-old houses to abandoned factories that have lost their owners similar to that of a stray dog or cat. There seems to be an ever-increasing number of these buildings, too, which represents a growing problem in our cities today. How do we deal with these abandoned properties and save the appearance and character of our inner cities? Over the years,

demolition has become the solution by simply destroying and flattening the entire house with everything in it, then sending it off to the landfill, a suitable burial site for a house's fragments that once stood prominently in its neighborhood. Wastes from demolition and construction represent a substantial amount of the total dumping in landfills today. Within the past few decades, an ancient process has reemerged as a way to decrease the amount of waste transported to landfills due to demolition. This process is called *deconstruction*. Simply speaking, deconstruction is the opposite of construction. In a more elegant definition, "Deconstruction is the systematic disassembly of buildings in order to maximize recovered materials reuse and recycling" (Chini).

There are two types of deconstruction: non-structural and structural. Non-structural deconstruction, also known as *soft-stripping*, is not nearly as an intensive process and hardly requires any learned skills or techniques. Soft-stripping simply encompasses the removal of interior items such as kitchen cabinets, lighting fixtures, plumbing accessories, etc. This method has been used for years by contractors because of its simplicity as well as its immediate financial results (The Pollution Prevention Program Office, U. S. EPA).

Structural deconstruction requires substantial amount of knowledge about the means and methods of construction, especially the structural components. Not only are interior furnishings removed, but roofs, walls, and floors are deconstructed; sometimes entire buildings are taken apart piece by piece until nothing remains. Structural deconstruction is on the rise in popularity because of its great environmental impacts. Many organizations have been founded within the past decade that specialize in this type of deconstruction.

Deconstruction Type	Description	Characteristics	Types of Salvaged Materials
Non-Structural (i.e. soft-stripping)	The removal for reuse of any building contents that do not affect the structural integrity of the building.	<ul style="list-style-type: none"> • Requires less planning and coordination than structural deconstruction. • Materials can be viewed and removed without much destructive access. • Uses few tools, and materials are salvaged relatively easily with minimum safety concerns. • Does not have a significant effect on project schedule 	<ul style="list-style-type: none"> • Finish flooring • Appliances • Cabinetry • Windows/doors • Trim • HVAC equipment • Fixtures/hardware • Fireplace mantels
Structural	The removal, for reuse, of building components that are an integral part of the building, or contribute to the structural integrity of the building.	<ul style="list-style-type: none"> • Involves a range of tools and mechanization • Heightened safety consideration, and longer time-frame. • Materials removed are typically large, rough products that are reused as building materials or remanufactured into value added products such as chairs, tables, and surface coverings. 	<ul style="list-style-type: none"> • Framing • Sheathing • Roof systems • Brick/masonry • Wood timbers/beams • Wood rafters • Floor joist system
Source: Adapted from U.S. Department of Housing and Urban Development (2000, 2001).			

Deconstruction presents numerous advantages over demolition, but it also presents a few challenges. One of the most notable positive impacts of deconstruction is that on the environment. By diverting thousands of pounds of debris from landfills each year,

deconstruction seeks to preserve and protect the environment. Landfills can be used longer with less waste being dumped. Another advantage is the increase in material reuse and recycle. The increased use of recycled materials is a common trend today, not only because of the lower cost to buy these materials, but because it is a sustainable practice. The hands-on aspect of deconstruction provides a simple and thorough opportunity to recycle materials. Each step of the process produces recycled materials that can most times be reused in additional projects. Reusing materials also requires less energy to be consumed in producing new materials, which means that deconstruction uses less overall energy than demolition even though it requires more man-hours on site.

While deconstruction presents some challenges, demolition, in some ways, is more practical. Demolition, in most cases, is substantially quicker to perform and the costs of disposing construction wastes are usually cheaper than deconstruction. Labor costs vary widely which makes deconstruction more of a risk than demolition. Almost every existing building built before the turn of the century was not designed with disassembly in mind making it difficult to softly deconstruct a building with every piece in perfect condition. With multiple steps and measurements to be considered, disassembly is not an easy task. Another challenge occurs because there are often no building codes or standards that address the reuse of materials in a building. Deconstruction is still relatively new to the industry requiring more time and effort into the process of tearing down an existing building. Demolition, on the other hand, is quick and to the point, which is an attractive solution for a project on a time constraint.

Environmental Impacts of Deconstruction

Most notably, deconstruction presents numerous environmental benefits to the world, setting it apart from its counterpart, demolition. “The US EPA has estimated that the materials debris from building renovation and demolition comprise 25 to 30% of all waste produced in the US each year” (Guy and Shell). One-third of all wastes come from construction related activities; one-third of all wastes that flow into a landfill are from construction. By focusing our attention on techniques to reduce the amount of construction and demolition waste, we can extend the lifetime of landfills. In turn, the creation of new landfills will be minimal, thus saving the integrity of the natural landscape.

Not only are landfills being filled and occupied by construction materials, but these materials most times could be recycled or even reused. “It is estimated that...only 20 percent of construction waste or demolition debris (C&D) is actually recycled” (Nace). The problem is not the amount of wastes from construction sites, but the amount that is not recycled. By creating a simple plan and organization for recycling, this problem can be greatly diminished. Many materials that are considered wastes can, in reality, be recycled or reused if disposed of properly. Mainly, these include drywall, wood, metals, and cardboard. “In addition to the manufacture of drywall for building construction, gypsum is also widely used as a soil amendment, in the production of cement, and as an ingredient in the manufacture of many types of commercial products” (Townsend). Drywall scraps are most times thrown into landfills, because people do not realize the opportunity that gypsum has as a recyclable. Also, gypsum does not create much profit like other well-known recyclable materials such as metals. The quick profit return from recycling aluminum, for example, is why it is a normal practice for

contractors. Understanding the implications of recycling on the environment is one of deconstruction's main benefits. Deconstruction diverts as much waste as possible from the landfill to be used in other applications, whether that be new construction or areas not related to construction.

"Based upon a review of deconstruction case studies, recovery rates of 50 percent are nearly universal at deconstruction sites and in many cases, as much as 90 percent of the materials will be reused or recycled" (Leroux and Seldman). People across the U.S. are taking this idea of reuse and recycle to the next level, too. Beginning in December 2007, Shannon Quimby was able to deconstruct her house and reuse and recycle 100% of the materials. She called the project the REX house (Reuse Everything Experiment). Everything inside and outside the house including the old-growth trees and landscaping from the previous house was transplanted or reused in the new construction house she built in the same location. Her reason: "I'm determined to show that with ingenuity, reclaiming an old home is practical, fun and a potential money saver" (REX Reuse Everything Experiment). Shannon demonstrates the great potential of deconstruction. When done right, reusing and recycling materials results in new construction that exemplifies the character of the old, and benefits everyone involved.

Another environmental benefit of reusing old materials is that it reduces the amount of raw materials used, and the amount of energy required to create all new materials. "Each year, the construction industry is responsible for consumption of more than one-third of the world's raw materials and about 10 percent of the total energy consumption in the United States" (Leroux and Seldman).

Impacts on the Construction Process

Deconstruction is not only a sustainable practice, but it offers a substantial amount of knowledge rarely found elsewhere. Hands-on learning expands a student's learning in areas that books and classroom environments cannot. Ball State University, which is prominently known for its immersive learning programs, is already putting this idea into practice.

"Immersive learning melds content, skills, societal need, and your interests into an intense, transformative experience" (Ball State University). Simply speaking, immersive learning programs present real-life situations for students to increase their skills in specific areas of interest. Forget the normal classroom; these programs stimulate students' learning in a different environment.

This semester, I have had the great opportunity to be part of one of these immersive learning programs at Ball State, in which I have gained an invaluable amount of new knowledge. Instead of a normal studio environment where design projects are conducted over the entire length of the semester, the studio I enrolled in pulls me out of studio into a real construction environment. My studio is performed under the direction of the ecoREHAB organization of Muncie and is directed by my professor Jonathan Spodek. EcoREHAB's goal is to sustainably rehabilitate existing housing in downtown Muncie that can then, in turn, be sold to low-income families who are in search of a home. Another one of ecoREHAB's missions is to "provide an immersive learning experience for students engaging them with ecoREHAB and the City of Muncie in the planning, costing, administration and construction of these projects" (ecoREHAB). Meant to teach students through hands-on processes, the organization seeks to familiarize them with actual construction decisions and procedures.

Initially, I was a little unsure how this studio would be beneficial to my future, but as the semester has progressed I have seen and experienced the numerous benefits from being a part of it. Little did I know how much I would learn about construction practices and techniques over the period of a few months. Ten senior Architect students, including myself, along with our professor have worked tirelessly over the duration of this semester, immersing us in a real, hands-on project outside the normal realm of studio.

Our project was an old, single-story house in Muncie's Old West End District near downtown. The house was built around the early 1900s and clearly showed many years of wear and tear from numerous families and more recently, the homeless. Upon first glance I thought there was no way we could salvage anything. It would definitely have been easier to bring in a wrecking ball the next day, demolish the entire house, and then start from scratch. It probably would have been more fun, too. However, we understood the need for rehabilitation and saw this as the best response and opportunity to save the character of an old house within a historic neighborhood.

Our professor, Jonathan Spodek, required us to write a journal about our experiences and thoughts about each workday throughout the semester. This journal is my basis for recording all of my personal thoughts and ideas that came up while working at the house. From the first day we worked on January 19, 2011, through the end of the semester, I recorded each day's activities that I accomplished which includes the entire process of deconstruction: from the initial removal of all kitchen cabinets, bathroom fixtures, and door hardware to the stripping of plaster, lathing, and studs (some structural) from the interior walls. In just a few

months of being involved in deconstruction, I have gained a good understanding of its benefits and shortcomings.

Personally, it was amazing to actually see and be a part of the deconstruction process from beginning to end. There was so much about the construction of a house that I never understood until this semester: from understanding that nothing, especially wood, ever lines up perfectly to figuring out the sequence of work activities. I find it easy as an architecture student to assume that everything in construction is perfectly cut and molded to the exact shape or length that you need on the jobsite. From our computers it seems like that is the case. However, it is quite the opposite. Construction is flexible, ever-changing, even during the construction of a building, and it took me until this semester to finally figure that out.

Another aspect I learned through the immersive learning experience is understanding how a house is built and how each piece of material is added in a specific sequence. For deconstruction, we viewed the whole and worked in reverse, removing everything from the inside one piece at a time until we were basically down to the house's shell. Of course, we understood the simple fact that doors and trim must be removed before the plaster, the plaster before the stud walls, and so on. However, there were processes beyond that we needed to factor as well. Which room do we start in? Do we start with the ceiling or the walls? How does this affect how and what we recycle or remove? These are just a few of the questions that we thought through before we proceeded to the next activity. Each step seemed to affect another, and that, in turn, affect two more. We were always looking at the steps in front of us becoming completely cognitive of the entire process. This studio experience implemented what we were taught in the classroom into a real-life situation.

Deconstruction as a Learning Tool

This study about the deconstruction process has revolved around this one main issue: how can deconstruction be used as a learning tool? Up to this point an overview of deconstruction, its main environmental benefits, as well as personal experiences within this process have tried to formulate a basic understanding and knowledge of what deconstruction actually is. There has already been a few allusions as to how deconstruction impacts not only students, but people who work in the construction industry as well. In this final section, there will be a further discussion over how deconstruction has the opportunity to be an important learning tool, for now and the future alike.

Society is changing. Was it not just over a decade ago when a gallon of gas was under a dollar? Today, it has reached the four-dollar mark in some areas. Or again, was it not just a few years ago when there was such a high demand for powerful trucks and SUVs such as the Hummer where there was not really a care for the MPGs that it produced? Today, vehicles are required to have a certain MPG in order to be on the market. What about the push to go paperless in a society that is moving more and more towards technology as a means for, well, everything? Everything seems to be going 'green.' Going 'green' means being sustainable and protecting the environment from overuse and wastes. As said previously, construction and demolition wastes comprise a substantial percentage of the world's total wastes into landfills. Deconstruction, on the other hand, tries to produce an opposite result. It saves landfills and the environment by redirecting the wastes into opportunities for reuse and recycling.

Deconstruction not only results in the reuse and recycling of materials, but it produces a general understanding of sustainability within the construction industry. Deconstruction

teaches what exactly can and cannot be recycled, what materials are suitable for reuse in another location, and the entire, or at least partial, preservation of existing structures. Having an understanding of how to recycle and reuse materials leads to a greater awareness; a greater awareness produces more applications of deconstruction; more projects that stray from demolition lead to a lesser impact to the environment. However, it is not only replacing demolition with deconstruction that reduces wastes but contractors who have a general understanding of what materials to recycle on a typical construction project is essential as well. Deconstruction simply provides that understanding and opportunity to recycle and reuse because materials will be more easily available as well.

Another situation where deconstruction is a prominent learning tool is with students and novice construction workers. Students especially related to construction would benefit greatly from being a part of a deconstruction process. What better way to understand how a building goes together than to see one be torn apart first? Deconstruction allows students to see the construction process in reverse, which then the students can transfer that knowledge into actually building something themselves. The forward process is easier to understand if there is a previous knowledge of each step first.

Architecture students also benefit from being involved with deconstruction. From my personal experiences this semester, I have realized how much I did not understand about a building, especially the details. By gaining an understanding of how a building goes together, I can now design with that knowledge in mind. Also, if questions arise about a specific piece of my design, I am more likely to have an answer, because I have the experience. Architecture students often only have a general understanding of how a building is built without a great

comprehension of specific details. With a greater knowledge through deconstruction, students will produce more coherent and involved projects where they have a greater awareness of how their design affects the construction process. Not only this, but architects and engineers will have a greater perception and awareness of the building's entire lifetime and will be able to design for deconstruction in the future when the building needs renovation.

“The overall objective of designing for deconstruction (D4D) is to reduce the environmental impacts such as pollution from the demolition of buildings, and to increase the stream of used and recycled building materials through designing for the recovery and the eventual reprocessing of building materials” (Design4Deconstruction.org).

By keeping in mind the eventual result of a building and knowing that most buildings progress through phases of renovation, designers can design for these instances even before it is built. D4D is a process that begins during the initial design process as materials and sustainable issues are thought about. “The selection of materials by building designers should take into account the results from different environmental assessments such as embodied energy, closing the materials loop, CO2 emissions, and so on in order to identify the most environmentally friendly stream of construction materials” (Design4Deconstruction.org).

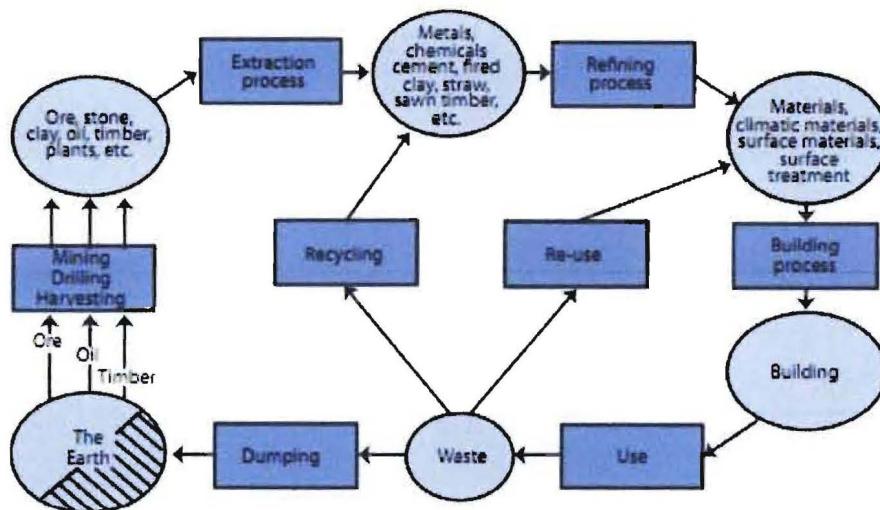


FIGURE 2—CLOSING THE LOOP IN THE MATERIAL LIFECYCLE

(Source—Bjorn Berg, "The Ecology of Building Materials")

According to Figure 2, closing the loop is the essential way to divert wastes from dumping into landfills. Using materials that have an easy opportunity to be removed from an existing building for reuse is a great advantage to have. The ease of reuse is reputable and appealing to owners and builders because there is a substantial cost benefit to it as well. Not only this, but closing the loop in material lifecycles reduces the amount of energy consumed to produce new, virgin materials. Instead of the normal, linear progression of materials from production, to construction, to demotion, to waste, D4D creates a circular cycle where the materials have a second lifetime. This is extremely important for designing sustainable buildings by reducing the environmental impact of a building.

Summary

Deconstruction is a process that has become increasingly practical and prominent within the construction industry over the past few decades. It will continue to grow and expand its influence as society pushes sustainable and 'green' practices, especially in material reuse and

recycle. Because reuse and recycle will become more expected and sought after, having a vision of deconstruction in the design of a building will contribute to more sustainable buildings. “By designing buildings to facilitate future renovations and eventual dismantlement, a building’s systems, components, and materials will be easier to rearrange, recover, and reuse” (The Pollution Prevention Program Office, U. S. EPA). Deconstruction facilitates a continued learning of what it means to recycle, what materials are advantageous to recycle, and how recycling an entire building has far greater benefits than demolition.

Deconstruction not only teaches students and contractors sustainable ideas, but it offers students a greater understanding of the construction industry. Hands-on, immersive learning opportunities allow students to learn how a building is pieced together. This knowledge will reflect in architecture or engineer students’ designs, a novice construction worker’s expertise, or any other person related to the construction industry. Also, having knowledge of the benefits of deconstruction can, and will, lead to designs for deconstruction in the future.

“Design for deconstruction can be studied from the perspective of deconstruction of existing buildings and the lessons learned from this research can be used to design for deconstruction in the future” (Guy and Shell).

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ARCH 402 Daily Journal (excerpts):

Wednesday, January 12, 2011

Today we took a walk through of the Gharkey St. house taking photos and getting an understanding of what we are dealing with. It seems like a large task ahead of us, because there is just a lot of junk inside the house that needs to be cleaned out. It is rather daunting, but after seeing the finished result at the Washington Street house and hearing how that house was in worse shape, I am more confident as we begin this project. I am looking forward to this semester and how the process of deconstruction will help me learn more about the construction process.



Wednesday, January 19, 2011

Our first workday at the Gharkey house. Cleaning up and securing the house for construction were our first priorities, so that is what we did for most of the afternoon. Once all the trash and junk inside the house was cleaned out and thrown in the dumpster, Ariel, Rudy, and I began taking apart the closet in the one bedroom. First we disassembled the door and hardware making sure we kept all the parts in order to be able to use it later. The door was in good shape and is quite unique. I think it would be

great to use in the house either for another closet or a pantry door. After the door and hardware was off, we took off the trim and the paneling. The paneling was in good shape but has paint on one side, so I do not know if we can use it again. We kept it, however, just in case there is an opportunity.

Monday, January 24, 2011

The house is really starting to look a lot better than when we first started. I helped finish taking apart the closet framing today. Then, we began taking down some of the walls, door frames, and trim. Tearing down the plaster and wood strips off the walls is rather fun, but it sure is a rough job. The dust and mess it creates is really annoying. I am not used to wearing the dust mask, and when I try to wear my safety glasses at the same time, all they do is fog up. We are going to be using new drywall on most of the walls so the plaster and wood strips are thrown in the dumpster. We cannot really reuse these materials. However, the wood framing and trim we are reusing so we are not throwing that away. The house has come a long way already and it is only the second day. We realized that most of the flooring is in pretty good shape so that is a plus. It should save us a good amount of time and money later on.



Wednesday, January 26, 2011

Today I worked on a different part of the building than I did on Monday. Rudy and I were in the basement for most of the day taking down the pipes, ducts, and electrical boxes. Since the house is planning on being rerun with electric and mechanical rough-ins, we are removing all the old parts. We are recycling the wire as well as the metal ducts and electrical boxes. Earlier this week we already recycled over seven hundred pounds of metal. That is pretty exciting because we still have a lot more to recycle. It was really tough working in the basement because there are no lights down

there so we have to rely on our headlamps and flashlights. There are also pretty tight spaces which I do not really enjoy, but I know that things have to be done so I will do them.

Friday, January 28, 2011

Today I helped transport all the trim, doors, and other materials that we are saving from the Gharkey house to the MUDS studio for storage while the rest of the demolition is finished. After dropping off the materials at the studio we picked up old unusable trim and boards from MUDS and took them back to the dumpster at Gharkey. We took a break from demo work today because some people were getting sick, and we wanted to do something different.



Monday, February 7, 2011

The final day of plaster demolition; such a good feeling. A few of us took down the last bedroom walls and ceiling really quick and spent the rest of the day cleaning it up. We threw in the dumpster all the remaining plaster and lathing. Then we went through the whole house and checked each stud and joist for any remaining nails. It was not really hard work today, but it was just time consuming and really dusty. I'm glad the plaster demolition is finally done. It was getting really monotonous, and I was sick of the dust and dirt that came with it.



Wednesday, March 16, 2011

We took a load of ferrous metal to OmniSource today. The load was around four hundred pounds and we were able to make forty-four dollar to go into our petty cash fund.

Wednesday, March 23, 2011

Today was actually a pretty fun day. We started taking apart the roof on the back porch today, which entailed Neil and me to begin tearing off the old shingles and tar paper. Then, we moved onto removing the furling boards one-by-one until we did not have enough room to stand. We had to be cautious where we stood because many of the roof boards and rafters had rotted or were not connected anymore.

By deconstructing the roof today, it gave me a better understanding of how a roof goes together. After learning the process of tearing it apart, I was able to see the forward process as well: from columns, to rafter, to purlin boards or sheathing, to tar paper, to shingles. This is a simple process, but it helped later on in the semester when I helped redesign the back porch.



Thursday, March 24, 2011

Neil, Jake, and I finished taking down the framing from the back porch. We removed all the lumber and siding. The back porch is now completely gone. It went really quick today, and we were able to save a lot of the lumber that we removed.

